MODELING OF DISCONTINUOUS DERIVATIVES IN MESHFREE METHODS REVISITED

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In most meshfree methods, the displacement at a point of evaluation is frequently approximated from the displacements of surrounding nodes by using the moving least squares approximation (MLSA) [1]. As results, it yields not only continuous displacement fields but also continuous displacement derivatives or strains. While, in FEM, it is interpolated by the nodal displacements of the element where the point is included and the first order derivative of displacement is continuous only in the element but discontinuous between the adjacent elements. Therefore, it is known that for the analysis of homogeneous problem, meshfree methods are more accurate than FEM.

However, in practical situation, there are many heterogeneous problems, such as structure composed of different kinds of members, composite materials and so on. In such problems, the discontinuity of displacement derivatives arises and they should be modeled and analyzed appropriately. These kinds of problems are naturally and easily analyzed by FEM, however, the meshfree methods using MSLA needs special treatments to take account of this discontinuity [2] [3] [4].

In this study, a simple and accurate modeling of discontinuous derivatives in meshfree methods is newly proposed. In the formulation the discontinuous bi-linear basis is simply introduced into MLSA instead of the linear basis and it is shown that it enables us to apply the conventional meshfree methods, such as the element free Galerkin method (EFGM), to the problems with discontinuous derivatives without any modification. Illustrated numerical examples demonstrate the potential of the proposed modeling method.

References

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